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In Re Application Of: **Itshak Bergel**

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Serial No.	Filing Date	Examiner	Group Art Unit
09/908,963	July 19, 2001	Sheila B. Smith	2681

Invention: **Deriving a More Accurate Estimate From Prediction Data in Closed Loop Transmit Diversity Modes**

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Signature

Dated: **December 22, 2003**

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Itshak Bergel	§	Group Art Unit:	2681
Serial No.:	09/908,963	§	Examiner:	Sheila B. Smith
Filed:	July 19, 2001	§		
For:	Deriving a More Accurate Estimate from Prediction Data in Closed Loop Transmit Diversity Modes	§	Atty. Dkt. No.:	ITL.0603US (P11744)
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APPEAL BRIEF

Dear Examiner:

Applicant hereby appeals from the Final Rejection dated September 10, 2003, finally rejecting claims 1-4, 6, 9-13, 15, 16 and 22-26.

I. REAL PARTY IN INTEREST

The real party in interest is Intel Corporation, the assignee of the present application by virtue of the assignment recorded at Reel/Frame 012015/0939.

Date of Deposit: December 22, 2003
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II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

III. STATUS OF THE CLAIMS

The application was originally filed with claims 1-30. Claims 27-30 have been allowed. Claims 1-4, 6, 9-13, 15, 16 and 22-26 have been finally rejected and are the subject of this appeal.

IV. STATUS OF AMENDMENTS

There are no unentered amendments.

V. SUMMARY OF THE INVENTION

A communications system 10, as shown in Figure 1, in one embodiment, includes a base station transceiver 12 that communicates with a mobile transceiver 14 over one or more radio links 16. In one embodiment, the mobile transceiver 14, shown in Figure 1, for a mobile user unit receives, or additionally, may transmit one or more radio communications when appropriately activated. In one embodiment, the mobile transceiver 14 comprises an interface 18 and a processor 20, both coupled to a storage unit 22 on which a channel controller application 24 may be stored for processing the radio communications. As described in more detail below, the channel controller application 24, when executed, may, in one embodiment, allow the mobile transceiver 14 to receive the radio communications over one or more of the radio links 16, where the radio communications may be used to communicate with the base station transceiver 12. Specification, p. 4, line 20 through p. 5, line 5.

As shown in Figure 1, in one embodiment, the mobile transceiver 14 further includes an antenna 26, which receives, or, additionally, transmits a radio communication over the one or more radio links 16. The radio communication includes a first transmission signal 32A and a second transmission signal 32B from the base station transceiver 12. The base station transceiver 12 comprises a plurality of adaptive antennas 30 including a first antenna 30(1) and a second antenna 30(m) to direct both the first transmission signal 32A and the second transmission signal 32B to the antenna 26. Specification, p. 5, lines 6-12.

However, the first and second transmission signals 32A and 32B may travel to the antenna 26 via multiple propagation paths. The base station transceiver 12 may transmit a pilot channel having a plurality of pilot symbols. The mobile transceiver 14 may receive and process the pilot channel to make a determination as to whether to interact with the base station transceiver 12. After an affirmative determination by the mobile transceiver 14, future channel prediction information concerning the first transmission signal 32A and/or the second transmission signal 32B may be transmitted back to the base station transceiver 12 via a feedback channel 35. Using channel estimation, the channel prediction information may be derived. In particular, the channel controller application 24 performs channel prediction based on the channel estimation in one embodiment, thereby producing accurate estimates of future channel states that may develop for future channels between the base station transceiver 12 and the mobile transceiver 14. Specification, p. 5, lines 13-25.

The mobile transceiver 14 of Figure 2 is similar to that of Figure 1 (and therefore, similar elements carry similar reference numerals) with the addition of more details for the interface 18

and the channel controller application 24. The interface 18 includes a receive interface 45, which receives the first transmission signal 32A and/or the second transmission signal 32B for processing via a first despreader 50a and a second despreader 50b. The first and second despreaders 50a, 50b despread the first and second transmission signals 32A, 32B from the base station transceiver 12 into channel propagation paths for the first antenna 30(1) (Figure 1) and the second antenna 30(m) (Figure 1), respectively. Although at least two antennas, the first and second antennas 30(1) and 30(m), of the plurality of adaptive antennas 30 are used in the illustrated embodiment, however, any number of more than two antennas of the plurality of adaptive antennas 30 may be readily employed. Specification, p. 6, lines 1-12.

In one embodiment, the channel controller application 24 includes a channel estimator 55, a channel predictor 57, and a feedback data generator 60. The channel estimator 55 provides the channel estimations for the first and second antennas 30(1), 30(m) shown in Figure 1. In turn, the channel predictor 57 predicts respective channel propagation paths from the channel estimations for the first antenna 30(1) and channel estimations for the second antenna 30(m). The feedback data generator 60 selects one or more antenna weight values from a predetermined set of weights for the first and second antennas 30(1) and 30(m) and calculates feedback information (e.g., selected weights) to be transmitted over the feedback channel 35 through a transmit interface 65. Alternatively, other appropriate feedback methods than the weight selection based as illustrated, may be advantageously used to carry feedback information concerning the channel state from the mobile transceiver 14 to the base station transceiver 12 to

adjust its transmission patterns over both the first antenna 30(1) and the second antenna 30(m). Specification, p. 6, lines 13-25.

In operation, the base station transceiver 12 of Figure 1, in one embodiment, transmits to the mobile transceiver 14 shown in Figures 1 and 2, a pilot channel over the one or more radio links 16. The pilot channel may include a first common pilot channel (CPICH) signal associated with the first antenna 30(1) and a second common pilot channel (CPICH) signal associated with the second antenna 30(m) in one embodiment. Upon receipt of the first and second common pilot channel signals, the processor 20 using the channel controller application 24 processes the first transmission signal 32A and/or the second transmission signal 32B. The channel controller application 24 generates the future prediction information (described in more detail below) for future channels that may exist over the one or more radio links 16 from base station transceiver 12 for the mobile transceiver 14. Specification, p. 7, line 18 through p. 8, line 3.

According to one embodiment of the present invention for a channel (e.g., the first transmission signal 32A or the second transmission signal 32B), the future channel prediction information comprises channel prediction terms. The channel controller application 24 derives first channel estimation terms from the first common pilot channel signal and second channel estimation terms from second common pilot channel signal. In one embodiment, the first and second channel estimation terms may be stored in the storage unit 22 for use to determine the channel prediction terms. As the channel estimation terms from each antenna of the plurality of adaptive antennas 30 may be associated with several propagation paths which arrive at different times, they can be advantageously stored in the storage unit 22 for later use with other

estimations from all other propagation paths. Accordingly, the channel prediction terms may be adaptively calculated from the first and second channel estimation terms by the channel controller application 24 in an iterative manner having one or more iterations (described in more detail later in the context of a software implementation of one embodiment the present invention). Thus, the future state of the channel may be predicted at the specified time based on the channel prediction terms. Using the channel prediction terms, a future transmission pattern may be adaptively controlled to match a future channel state. Specification, p. 8, lines 4-20.

In one embodiment, the first channel estimation terms may correspond to a channel estimation term calculated in at least one iteration prior to a current iteration of the one or more iterations. Likewise, the second channel estimation terms may correspond to a channel estimation term calculated in the current iteration of the one or more iterations. Specification, p. 8, lines 21-25.

As an example, the first common pilot channel signal is received from the first antenna 30(1) and the second common pilot channel signal is received from the second antenna 30(m). First and second channel propagation paths associated with the first and second antennas 30(1), 30(m) may be separated based on the first and second common pilot channel signals. For the first and second channel propagation paths, phase and magnitude of the channel (e.g., the first transmission signal 32A or the second transmission signal 32B) may be estimated to derive the first and second channel estimation terms in one embodiment. Specification, p. 9, lines 1-8.

Using the channel prediction and feedback calculation algorithms, in one embodiment, a selection of a particular antenna weight value may enable an accurate matching of a future state

of transmission to a future channel state. Since a set of allowed antenna weights are known a priori and may not change over time, can be determined a priori for all possible values of weights and stored in a lookup table. Alternatively, the set of allowed antenna weights may be periodically updated, if desired. In any case, the set of allowed antenna weights may be advantageously stored either in the mobile transceiver 14, the base station transceiver 12, or remotely in any suitable storage device. Specification, p. 9, lines 9-16.

The channel prediction algorithm may be trained from the first and second (e.g., past and present) channel estimation terms associated with each antenna, to learn channel propagation paths resulting from transmission patterns for any participating antenna of the plurality of the adaptive antennas 30. Thus, to adjust a future transmission pattern of the transmitter from a particular antenna, such as that of the first and second antennas 30(1), 30(m) one or more antenna transmission characteristics may be adaptively controlled based on the channel prediction terms. To this end, based on the channel prediction terms, a specific antenna weighted value may be selected for that particular antenna for accurately matching of the future state of transmission of the future channel from the particular antenna. Specification, p. 10, lines 1-10.

In particular, from prediction of channel propagation paths based on transmission patterns, the feedback calculation algorithm of the channel controller application 24 may find the best antenna weighted value out of the set of allowed antenna weights to be applied to an active or participating antenna for matching the future state of transmission to the future channel from the active or participating antenna at a specified time according to one embodiment of the present invention. The selected antenna weighted value, or in some situations a plurality of

selected antenna weighted values for one or more active or participating antennas, may be coded (e.g., as 2 or 4 bits) and signaled to the base station transceiver 12 through the interface 18 and the antenna 26 over the feedback channel 35, in one embodiment. The base station transceiver 12 receives the selected antenna weighted value from the feedback channel 35 to multiply with an antenna input of the antennas 30(1) and/or 30(m) the selected antenna weight value. For example, the selected antenna weight value may be applied to the antenna input of at least one of the first and second antennas 30(1), 30(m), or alternatively, to both the first and second antennas 30(1), 30(m). In this way, the selection of a particular antenna weight value may enable an accurate matching of the future state of transmission to the future channel state. Specification, p. 10, line 11 through p. 11, line 2.

One embodiment of the present invention includes transmitting data using the plurality of adaptive antennas 30 that transmit data using a method of transmission known as "a transmit diversity mode." Transmitting data with the plurality of adaptive antennas 30 is a technique implemented by measuring the channel characteristics and modifying the gain and phase of signals applied to each antenna input of an active antenna array including the first antenna 30(1) and/or the second antenna 30(m) in order to create an antenna transmission pattern that maximizes the power delivered to the mobile user unit. Thus, by employing a transmit diversity mode at the base station transceiver 12, in one embodiment, the distortions from multipath interference may be significantly reduced in the mobile transceiver 14. More specifically, specific multipath events can be avoided since the spacing of the plurality of adaptive antennas

30 ensures that not both of the first and second antennas 30(1), 30(m) will experience the same multipath event at the same time. Specification, p. 11, lines 3-15.

A typical closed loop transmit diversity mode may use the feedback channel 35 to transmit feedback information, such as at a rate of 1500 bits per second (bps). As an example, transmission of a feedback word (e.g., 2 to 4 bits wide) may result in an effective feedback delay of 0.7 to 1.3 milliseconds (ms) (excluding appropriate propagation delay and processing delay). Embodiments of the present invention are in no way limited to system with the enumerated characteristics. Specification, p. 12, lines 19-24.

For this purpose, in one embodiment, the first and second antennas 30(1), 30(m) of plurality of adaptive antennas 30 may be operated in a closed loop transmit diversity mode. An adaptive feedback for channel prediction terms comprising the at least one weighted value of the one or more weighted values may be provided over the feedback channel 35 to the first and second antennas 30(1), 30(m) of the plurality of adaptive antennas 30. In this way, at the specified time, the future transmission patterns from at least one antenna of the first and second antennas 30(1), 30(m) may be controlled to substantially reduce the effective loop delay in the closed loop transmit diversity mode. Specification, p. 13, line 19 through p. 14, line 2.

The channel controller application 24, in another embodiment, uses an adaptive channel prediction algorithm in the mobile transceiver 14 to predict a channel state at a specified future time, thereby reducing the effective delay in the closed loop. In one embodiment, such use of the adaptive channel prediction algorithm, for example, may improve the performance of the mobile transceiver 14 while operating in a 3GPP closed loop diversity mode, and may enable the

operation of this mode for the mobile transceiver 14 at higher velocities. Specification, p. 14, lines 3-9.

The adaptive channel prediction algorithm provides the channel prediction to generate a future prediction of each of the channel propagation paths (from each of the plurality of adaptive antennas 30). The predictions of the channel (e.g., the first transmission signal 32A or the second transmission signal 32B) ideally be as close as possible to the actual state of the channel (e.g., the first transmission signal 32A or the second transmission signal 32B) over the radio links 16 at the future time in which the base station transceiver 12 will apply the relevant antenna weighted value to an antenna input of a participating or active antenna among the plurality of adaptive antennas 30. More specifically, the predictions of the channel may match the average channel state at the range of times that the specific antenna weighted value or values (computed at present time) will be effective at the base station transceiver 12. Specification, p. 14, lines 10-20.

Figures 4A and 4B show programmed instructions performed by the channel controller application 24 (Figure 1) of the mobile transceiver 14 (Figure 1) according to one embodiment of this invention. As shown in Figure 4A, at block 85, from a first common pilot channel signal at least one first channel estimation term may be derived. Likewise, at block 87, from a second common pilot channel signal, at least one second channel estimation term may be derived. At block 89, for a channel, channel prediction terms may be determined from both the first and second channel estimation terms. Based on the channel prediction terms, at block 91, a future

transmission pattern of the transmitter at a specific time may be controlled. Specification, p. 16, lines 15-23.

In one embodiment, the mobile transceiver 14, such as mobile user equipment may use programmed instructions 100 (e.g., software code) when a transmission is received from at least two antennas 30(1), 30(m) (at block 105) of the base station transceiver 12 in channels including at least two common pilot channel signals as shown in Figure 4B. Next, the channel estimation terms may be derived (at block 110) from the two common pilot channel signals. The output signal results, which include the channel estimation terms, may be stored (at block 115) for the present case in the storage unit 22 (Figure 1) from which they can be later accessed. Specification, p. 17, lines 1-8.

To compute the channel prediction terms for selecting one or more weighted values for the two antennas 30(1) and 30(m), the past and present channel estimation terms may be used (at block 120) by the channel controller application 24 (Figure 2). Particularly, in one embodiment, a set of weight selection terms for antennas at a base station (e.g., the base station tranceiver 12 (Figure 1)) may be received (at block 125). Based on the channel prediction terms, the weight selection terms may be used to select weighted values for the two antennas (at block 130). One or more adaptive iterations 132 may be performed to accurately estimate or predict future transmission patterns of the first and second antennas 30(1) and 30(m) for the mobile user equipment through the programmed instructions 100. The selected weighted values may be fed back to the base station (at block 135), which may accurately estimate or control the future state

of transmissions from the first and second antennas 30(1), 30(m) located at the base station transceiver 12 at the block 140. Specification, p. 17, lines 9-21.

In general, at block 155, the channel prediction software 150 receives transmission channels (e.g., first and second transmission signals 32A, 32B of Figure 1) and common pilot channel signals for each participating antenna of the plurality of adaptive antennas 30 (Figure 1). Using information determined at block 105 (Figure 4B) the channel prediction software 150 despreads the transmission channel and common pilot channel signals for each antenna to separate channel propagation paths at block 110 and 115 (Figure 4B). Then, the channel prediction software 150 may estimate phase/amplitude for each transmission channel for each of the channel propagation paths to derive present channel estimation terms for each channel, as shown in block 165. Specification, p. 18, lines 5-13.

Using present channel estimation terms and accessing past channel estimation terms (e.g., stored in storage unit 22 of Figure 1), the channel prediction software 150 may compute channel prediction terms for each of the channel propagation paths for each participating antenna as depicted in block 170. In turn, the weighted values for each participating antenna based on the present and past channel prediction terms may be determined from the received weight selection terms for antennas as included in block 175. From here, the selected weighted values may be provided to each participating antenna as shown in block 180. Finally, antenna inputs of each participating antenna of the plurality of adaptive antennas 30 (Figure 1) may be multiplied with the selected weighted value to predict the transmission of a future channel as indicated in block 185. Specification, p. 18, lines 14-23.

One or more antenna specific weighted selected values (e.g., w_1 through w_k) may weight the set of spread-scramble signals 208(1) through 208(m) via a set of second multipliers 210(1) through 210 (m) to provide a set of weighted-spread-scramble signals 212(1) through 212(m). The set of weighted-spread-scramble signals 212(1) through 212(m) are then combined with respective common pilot channel of the common pilot channels $CPICH_1$ through $CPICH_m$ at a corresponding summer 215 of a set of summers 215(1) through 215(m). Specification, p. 19, lines 11-17.

In one embodiment, the antenna specific selected weighted values are determined from the channel prediction information derived from the feedback channel 35. Thus, in response to the channel prediction information concerning the future state of the traffic channel to the mobile transceiver 14 (Figure 1), the antenna specific selected weighted values are generated at the block 230 in the base station transceiver 12 to control at the specified time a transmission pattern over the traffic channel from the various number of antennas of the plurality of adaptive antennas 30. Specification, p. 20, lines 5-11.

In one embodiment, to compute the feedback information (FIB), the mobile transceiver 14 uses the common pilot channel (CPICH) to separately estimate the channels seen from the first and second antennas 30(1), 30(m). For instance, once every slot, the mobile transceiver 14 computes the phase adjustment, ϕ, and the amplitude adjustment that is to be applied at the UTRAN access point of the base station transceiver 12 to maximize the mobile transceiver 14 received power. In one case, a selection of the best antenna specific weighted value may be accomplished by e.g., solving for an antenna specific weighted value that maximizes received

power defined as a function of channel prediction terms derived from the estimated channel impulse responses for the first and second antennas 30(1) and 30(m). Alternatively, the best antenna specific weighted value may be, for example, determined to maximize a criterion being a function of the channel prediction terms derived from an estimated channel impulse response. Alternatively, another appropriate method based on maximizing signal-to-interference ratio (SIR) may be advantageously used for weight selection. Specification, p. 20, line 20 through p. 21, line 9.

In operation, the mobile transceiver 14 feeds back over the feedback channel 35 (Figure 1) to the base station transceiver 12 (e.g., to the UTRAN access point) the feedback information for adaptation of the first and second antennas 30(1) and 30(m), i.e., based on which phase and/or amplitude settings to be adjusted accordingly. In one embodiment, a set of feedback signaling message (FSM) bits are transmitted over the feedback channel 35. The FSM bits may be embedded in a FIB field of uplink DPCCH slot(s) (e.g., the transmit power control (TPC) field in the 3GPP standard) assigned to the closed loop mode transmit diversity. The FIB field is used to transmit the amplitude, i.e., power and phase settings corresponding to the best antenna specific weighted value, respectively. Specification, p. 21, lines 10-19.

The mobile user unit or user equipment (UE) (such as mobile transceiver 14 (see Figure 1)), in one embodiment, may be any processor-based system including a wireless phone, computer, personal digital assistant (PDA), pager, portable music player, or any other device capable of receiving information over one or more communication links (such as the radio links

16 (see Figure 1)). In one embodiment, the mobile user unit or user equipment may be a readily transportable device, such as a hand-held device. Specification, p. 21, lines 20-25.

VI. ISSUES

A. Is Claim 1 Anticipated by the Komatsu I Reference?

B. Is Claim 4 Rendered Obvious Over the Komatsu I Reference?

C. Is Claim 6 Rendered Obvious Over the Komatsu II Reference?

D. Is Claim 15 Rendered Obvious Over the Komatsu II Reference?

VII. GROUPING OF THE CLAIMS

While for purposes of this appeal, claims 1-3, 5, 7-14, and 22-26 may be grouped together; the claims 15-21 may be grouped in another group. The patentability of each group and claims 4, 6 is discussed below.

VIII. ARGUMENT

All claims should be allowed over the cited references for the reasons set forth below.

A. Is Claim 1 Anticipated by the Komatsu I Reference?

Claim 1 stands rejected under 35 U.S.C. § 102(e) over U. S. Patent Publication 2001/0046873 (*Komatsu I*). The method of claim 1 calls for a method including determining for a channel, channel prediction terms from both first channel estimation terms derived from first common pilot channel signal and second channel estimation terms derived from second common pilot channel signal. Using the channel prediction terms, control over future transmission patterns of the channel may be enabled.

1. <u>Known pilot signals found in a pilot channel must be used for deriving channel estimation terms that determine channel prediction terms</u>.

The rejection fails to show where *Komatsu I* purportedly teaches or suggests that the upward and downward link signals are the same as common pilot channel signals. Missing use of common pilot channel signals, *Komatsu I* cannot anticipate claim 1. That is, the *Komatsu I* reference without the use of known pilot signals from a pilot channel to derive channel estimation terms that determine channel prediction terms, enabling control thereof in future transmission patterns, fails to anticipate the limitations of claim 1. *Komatsu I* neither teaches nor suggests use of common pilot channel signals, let alone in a way claimed in claim 1. In fact, there is no teaching or a specific hint as to use of common pilot channel signals.

Specifically, *Komatsu I* fails to teach or suggest determining channel prediction terms from different channel estimation terms derived from corresponding common pilot channel signals. There is no teaching in the *Komatsu I* reference as to use of known pilot signals from a pilot channel, let alone to derive channel estimation terms that determine channel prediction terms, enabling control thereof in future transmission patterns. In this manner, use of known pilot signals from a pilot channel in the claimed combination of claim 1 is not taught or suggested by *Komatsu I*, depriving accurate estimate of the channel parameters. Therefore, consideration of the specific claim limitations of independent claim 1 involving use of common pilot channel signals to determine channel prediction terms for a channel, enabling control over future transmission patterns of the channel is respectfully requested.

As such, predicting a downward channel by estimating a downward channel on the basis of received downward signal is insufficient to indicate that for a quickly changing transmission

channel, between the base station and a mobile user unit, future transmission patterns may be controlled using a known common pilot channel signal capable of providing a precise channel state knowledge that accurately estimates the channel parameters while compensating for antenna transmission in closed loop transmit diversity modes. Accordingly, claim 1 is not anticipated by the teachings of *Komatsu I.*

The Examiner contends that estimating the downward channel on the basis of the received downward signal is determining channel prediction terms and estimating the upward channel on the basis of the received downward signal from different channel estimation terms is deriving different channel estimation terms corresponding to common pilot channel signals. The Examiner therefore concludes that the upward link and downward link signals are the same as common pilot channel signals.

Komatsu I merely uses upward and downward link signals to perform channel estimation at a mobile terminal. The mobile terminal in the *Komatsu I* reference receives signals from the base station which receives the control command from the mobile terminal and executes, on the basis of the control command, the antenna switching transmission diversity.

The Examiner contends that in *Komatsu I* [see 0027 of the Komatsu reference] a downward link estimation unit for estimating the downward channel on the basis of the received downward signal reads on determining channel prediction terms. Likewise, [see 0028 of the *Komatsu I* reference] an upward link estimation unit for estimating the upward channel on the basis of the received downward signal reads on different channel estimation terms derived corresponding to the common pilot channel signals.

As claimed, to perform channel estimation at the mobile station, for example, the base station may transmit a pilot channel. Using the pilot channel, a targeted mobile user may acquire desired channel parameters for acquiring appropriate timing and other information. The pilot channel may include a first common pilot channel signal associated with a first antenna and a second common pilot channel associated with a second antenna. Upon receipt of the first and second common pilot channel signals, a processor using a channel controller application may process the first and/or second transmission signals. More so, first and second channel propagation paths associated with the first and second antennas may be separated based on first and second common pilot channel signals. Specifically, to compute the feedback information (FIB), the mobile transceiver 14 uses the common pilot channel (CPICH) to separately estimate the channels seen from the first and second antennas 30(1), 30(m). See Applicant's specification on page 20, lines 20-23.

2. <u>The rejection is based on a notion that absence of a precise channel state knowledge enables control of future transmission patterns of the channel</u>.

There is no suggestion whatsoever in the *Komatsu I* reference that a compensation technique for transmission over a channel is based on making sole use of known pilot signals to enable control over future transmission patterns of the channel using the channel prediction terms. While communicating using transmit diversity in a closed-loop mode between a base station and a mobile user unit, the *Komatsu I* reference cannot adequately compensate for certain transmission and signal capture-related distortions absent a precise channel state knowledge.

The Examiner asserts that estimating a downward channel on the basis of received downward signal for predicting a downward channel controlled by a control command is "determining channel prediction terms from two different channel estimation terms derived each from a corresponding common pilot channel signal" and thus, reasons that the method of claim 1 is taught by *Komatsu I*. In contrast, *Komatsu I* estimates a downward channel on the basis of the received downward signal for predicting a downward channel which is used at the time when the base station is controlled by the control command generated on the basis of the predicted downward channel.

However, in the *Komatsu I* reference, there is no teaching whatsoever that the base station transmits a pilot channel. In fact, in the *Komatsu I* reference, there is no teaching that the base station transmits a pilot channel having one or more pilot signals, let alone known common pilot channel signals in a way that enables accurate estimation of channel parameters.

For at least this reason alone, claim 1 is in condition for allowance.

B. Is Claim 4 Rendered Obvious Over the Komatsu I Reference?

Claim 4 stands rejected under § 102(e) over *Komatsu I* (U.S. Patent Publication 2001/0046873). Claim 4 calls for adaptively calculating the channel prediction terms from the first and second channel estimation terms in one or more iterations. *Komatsu I*, neither teaches nor suggests use of adaptively calculating the channel prediction terms from the first and second channel estimation terms derived from respective common pilot channel signals. Without a specific teaching, *Komatsu I* fails to teach or suggest use of adaptive calculations for the channel

prediction terms. In this manner, claim 4 is patentably distinguishable over the *Komatsu I* references.

C. Is Claim 6 Rendered Obvious Over the Komatsu II Reference?

Claim 6 stands rejected in view of *Komatsu II* (WO 00/72464) as being unpatentable under 35 U.S.C. § 103(a). Claim 6 involves adaptively calculating which includes receiving one or more weighted values associated with one or more antennas of a plurality of antennas where the first common pilot channel signal is from a first antenna of the plurality of antennas and the second common pilot channel signal is from a second antenna of the plurality of antennas. Absent this showing in the *Komatsu II* reference, the Examiner's assertion that adaptively calculating is somehow obvious for a certain reason, motivation of which is not taught or suggested in the cited reference itself, fails to establish a *prima facie* case of obviousness for claim 6.

D. Is Claim 15 Rendered Obvious Over the Komatsu II Reference?

With regard to claim 15 which stands rejected under 35 U.S.C. § 103(a) over *Komatsu II* (WO 00/72464). Claim 15 calls for an apparatus comprising a communication interface and a processor communicatively coupled to the communication interface to determine for a channel, channel prediction terms.

The processor determines channel prediction terms from both first channel estimation terms derived from first common pilot channel signal and second channel estimation terms derived from second common pilot signal to enable control over future transmission patterns of

the channel using the channel prediction terms. The Examiner fails to show that in the *Komatsu II* reference use of common pilot channel signals is either suggested or disclosed. In *Komatsu II* reference there is no use of common pilot channel signals to derive channel estimation terms in order to determine channel prediction terms that control a future transmission state over the channel at specific time. Therefore, a *prima facie* case of obviousness for independent claim 15 is not established. For at least the reasons set forth above reversal of § 103 rejection of claim 15 is requested.

D. CONCLUSION

The Applicant's respectfully request that each of the final rejections be reversed and that the claims subject to this appeal be allowed to issue.

Respectfully submitted,

Date: December 22, 2003

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APPENDIX OF CLAIMS

1. A method comprising:

determining for a channel, channel prediction terms from both first channel estimation terms derived from first common pilot channel signal and second channel estimation terms derived from second common pilot channel signal; and

enabling control over future transmission patterns of the channel using the channel prediction terms.

2. The method of claim 1, including predicting a future state of the channel at a specified time based on the channel prediction terms.

3. The method of claim 2, including storing the first and second channel estimation terms in order to determine the channel prediction terms in response to the first and second common pilot channel signals, respectively.

4. The method of claim 3, including adaptively calculating the channel prediction terms from the first and second channel estimation terms in one or more iterations.

5. The method of claim 4, wherein adaptively calculating includes:

receiving antenna transmission characteristics associated with one or more antennas of a plurality of antennas in order to controllably adjust the future transmission patterns of the channel; and

selecting at least one antenna transmission characteristic from the antenna transmission characteristics based on the channel prediction terms.

6. The method of claim 4, wherein adaptively calculating includes receiving one or more weighted values associated with one or more antennas of a plurality of antennas where said first common pilot channel signal is from a first antenna of the plurality of antennas and said second common pilot channel signal is from a second antenna of the plurality of antennas.

7. The method of claim 5, including using a feedback signal based on the channel prediction terms to control the future transmission patterns of the channel according to the future state of the channel at the specified time.

8. The method of claim 6, including:

selecting at least one weighted value from the one or more weighted values based on the channel prediction terms;

providing the at least one weighted value to the first and second antennas to accurately assess the future state of the channel at the specified time; and

separating first and second channel propagation paths associated with the first and second antennas based on the first and second common pilot channel signals.

9. The method of claim 8, including estimating phase and magnitude of the channel for the first and second channel propagation paths to derive the first and second channel estimation terms.

10. The method of claim 4, wherein the first channel estimation terms correspond to a channel estimation term calculated in at least one iteration prior to a current iteration of the one or more iterations.

11. The method of claim 10, wherein the second channel estimation terms correspond to a channel estimation term calculated in the current iteration of the one or more iterations.

12. The method of claim 6, including operating the first and second antennas of the plurality of antennas in a closed loop transmit diversity mode.

13. The method of claim 12, including providing feedback, including the at least one weighted value of the one or more weighted values, to the first and second antennas of the plurality of antennas.

14. The method of claim 13, including controlling at the specified time a transmission pattern over the channel from at least one antenna of the first and second antennas to match the future state of the channel and substantially reduce the effective loop delay in the closed loop transmit diversity mode.

15. An apparatus comprising:

a communication interface; and

a processor communicatively coupled to the communication interface, the processor to determine for a channel, channel prediction terms from both first channel estimation terms derived from first common pilot channel signal and second channel estimation terms

derived from second common pilot channel signal and to enable control over future transmission patterns of the channel using the channel prediction terms.

16. The apparatus of claim 15, wherein the processor predicts a future state of the channel at a specified time based on the channel prediction terms.

17. The apparatus of claim 15, further comprising:

a storage coupled to the processor to store the first and second channel estimation terms in order to determine the channel prediction terms in response to the first and second common pilot channel signals, respectively.

18. The apparatus of claim 17, wherein the processor adaptively calculates the channel prediction terms from the first and second channel estimation terms in one or more iterations.

19. The apparatus of claim 18, wherein the processor:

receives antenna transmission characteristics associated with one or more antennas of a plurality of antennas in order to controllably adjust the future transmission patterns to the channel; and

selects at least one antenna transmission characteristic from the antenna transmission characteristics based on the channel prediction terms.

20. The apparatus of claim 19, wherein the processor:

provides a feedback signal based on the channel prediction terms to control the future transmission patterns of a transmitter according to the future state of the channel at the specified time.

21. The apparatus of claim 18, wherein the processor:

receives one or more weighted values associated with one or more antennas of a plurality of antennas, said first common pilot channel signal is from a first antenna of the plurality of antennas and said second common pilot channel signal is from a second antenna of the plurality of antennas to operate first and second antennas in a closed loop transmit diversity mode;

provides feedback having the at least one weighted value of the one or more weighted values to the first and second antennas; and

controls at the specified time the future transmission patterns over the channel from at least the first and second antennas of the plurality of antennas.

22. An article comprising a medium storing instructions that enable a processor-based system to:

determine for a channel, channel prediction terms from both first channel estimation terms derived from first common pilot channel signal and second channel estimation terms derived from second common pilot channel signal; and

enable control of future transmission patterns of the channel using the channel prediction terms.

23. The article of claim 22, further storing instructions that enable the processor-based system to predict a future state of the channel at a specified time based on the channel prediction terms.

24. The article of claim 23, further storing instructions that enable the processor-based system to store the first and second channel estimation terms in order to determine the channel prediction terms in response to the first and second common pilot channel signals, respectively.

25. The article of claim 24, further storing instructions that enable the processor-based system to:

adaptively calculate the channel prediction terms from the first and second channel estimation terms in one or more iterations; and

receive antenna transmission characteristics associated with one or more antennas of a plurality of antennas in order to controllably adjust the future transmission patterns of the channel; and

select at least one antenna transmission characteristic from the antenna transmission characteristics based on the channel prediction terms.

26. The article of claim 25, further storing instructions that enable the processor-based system to:

receive one or more weighted values associated with one or more antennas of a plurality of antennas, said first common pilot channel signal is from a first antenna of the plurality of antennas and said second common pilot channel signal is from a second antenna of the plurality of antennas;

select at least one weighted value from the one or more weighted values based on the channel prediction terms;

provide feedback having the at least one weighted value of the one or more weighted values to the first and second antennas of the plurality of antennas; and

control at the specified time a transmission pattern over the channel from at least one antenna of the first and second antennas.